PROGRESS REPORTS
FROM
EXPERIMENT STATIONS

SEASON 1955-1956

SUDAN

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PROGRESS REPORTS FROM EXPERIMENT STATIONS

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SUDAN

COTTON BREEDING STATIONS
PROGRESS REPORT FOR THE SEASON 1955-56

	Planting Dates.	*Picking Dates.*
Gezira	Mid August to mid September.	January to March.
Gash	Late August to late September.	Mid January to April.
Tokar	Early September to mid October.	January to May.
Kordofan	Mid June to mid August.	Mid October to February.
Zeidab	First half May	September to December.
Equatoria	Mid May to August.	October to mid February.

Introductory Note.

BY

M. F. ROSE.

Staff.

Mr. A. Low, Cotton Breeder, Kadugli, was transferred to Wad Medani on March 1st 1956. His time will be devoted not only to the Egyptian crop but also to breeding work on American types. He will hold a watching brief for the Kordofan crop and will pay a yearly visit to that area.

Ahmed Eff. Abdel Rahman was appointed Inspector Cotton Propagation in December 1955 to fill the post vacated by Mohammed Eff. Taha El Faki in March 1955. His headquarters will be Wad Medani.

Visitors.

Mr. H. M. Parker paid a brief visit to Shambat and Wad Medani in early September 1955 while en route to Namulonge. On his return trip to England he again broke his journey in the Sudan, visiting Shambat, Wad Medani and the central Gezira in mid December.

Tours.

At the request of the Government, Mr. A. Low toured potential cotton growing areas in Darfur Province in February 1956. His trip (approximately 2,500 miles) yielded very valuable information, a general synopsis of which will be published shortly.

Dr. S. O. S. Dark toured the Eastern and Western Jebels in December 1955, with headquarters at the Cotton Breeding Section, Kadugli.

Commercial Cotton in the Sudan.

Areas and yield are given below: —

(i) *Egyptian Cotton*

	Area (feddans)	*Yield (kantars)*
Gezira	238,926	1,162,394
White Nile	113,883	537,247
Abdel Magid	9,985	29,595
Gash	36,175	80,541
Tokar	nil	nil
	398,969	1,809,777

(ii) *American Cotton*

Irrigated	6,927	13,056
Flood (Abu Habl)	2,400	3,331
Raingrown	168,097	224,118
	177,424	240,505

One feddan = 1·038 acres. 1 Kantar = 315 rotls = 312 lb. seed cotton.

In terms of seed cotton returns for the 1955-56 season there is an increase of 2·8% over those of the record season 1950-51. A proportionate increase in bales lint (400 lb.) from 526,000 to over 540,000 can thus be reasonably expected. Since all G.O.T.'s are not yet available absolute figures for lint bales cannot be given for this record season of production.

Owing to droughty conditions and in consequence a poor Baraka flow, no cotton was grown in the Tokar Delta. Watering conditions in the Gash were also difficult, with some reduction in area. Owing to these unforeseen circumstances the first main wave of BLR 14/25 for Gezira planting was reduced from 480 to 86 acres.

On October 21st the Guneid Scheme, supplied by pump irrigation from the Nile, was opened on the East Bank opposite Hassa Heisa. This adds a further 10,000 feddans of cotton to the Gezira Board area.

The average returns for the Sudan Gezira Board were 4·865 kantars per feddan (1,462 lb. seed cotton per acre) an increase of approx. 16% over the general average.

The rapid increase of Private Schemes (105,510 acres), approaching 50% of the effective area of the Sudan Gezira Board, is worthy of note.

THE GEZIRA STATION

BY

M. F. ROSE AND L. C. HUGHES.

Climate and Crop.

In view of the poor pre-sowing rains and the early closing down of the crop (especially Sakel types) grave doubts were entertained as to final yields. July to mid August rainfall was only 141 mm., 77 mm. below the general average 1919-1942, and local estimates for the Farm, based on the adjacent Centre Group, were about 10% below average (S and L types unmanured and unsprayed). Contrary to expectations, however, overall yields of 1,669 lb. of seed cotton per acre were returned, 26% above average. Sakel yielded 1,173 lb. of seed cotton per acre from 51 acres while the returns for X1730A (86 acres) were 2,039 lb., the best yield for 11 years excluding the phenomenal season of 1950-51. Grade, however, was bad, the final figure standing at 5·65.

Rainfall conditions were somewhat abnormal in the early part of the season, with June rainfall double and July rainfall half that of the 1919-42 average. Temperatures generally were up on those of the previous season, though cold spells were experienced in November (8th-12th), December (8th) and January (1st-5th and 14th-5th February). Humidities were above average for October and November.

Although the crop had little check (except for whitefly) senescence and leafshed became marked from the middle of December, especially on Sakel types. By the third week in December all Sakel types had closed down. L types were similarly affected but to a lesser degree. This very early closing down was a matter of some concern, for it was a month earlier than in the previous season (third week in January), a date then considered early.

Despite the shortage of early rains flea beetle damage was very light, in fact negligible. A little American bollworm was noted in the American cottons but this did not affect the main Egyptian crop. Blackarm was in evidence on all susceptible material, reducing yields by an estimated 9% (see G.R.F. Variety Trial). A little leafcurl was noted in the first half of November but did no damage to experimental material. Whitefly was the major pest, with a very marked rise in population from November 19th.

A strike from August 13th-20th, timed to dislocate the planting programme, had little effect. Planting proceeded smoothly yet slowly: conditions were good and excellent stands were finally obtained.

TABLE 1.

METEOROLOGICAL READINGS.

G.R.F. 1955-56.

Date		*Mean max.* °F.	*Mean min.* °F.	*Total Rainfall mm.*	*Average Relative Humidity 8 a.m.*
April	1955	107 (106)	73 (68)	0·3 (2·5)	20 (19)
May	,,	106 (107)	75 (74)	24·2 (16·3)	33 (23)
June	,,	103 (103)	74 (76)	62·0 (7·5)	50 (49)
July	,,	97 (91)	72 (70)	77·2 (158·0)	76 (80)
August	,,	93 (88)	71 (70)	73·1 (161·7)	73 (84)
September	,,	94 (91)	70 (70)	73·5 (106·7)	76 (79)
October	,,	101 (99)	71 (69)	9·3 (10·1)	55 (50)
November	,,	97 (100)	63 (65)	— (—)	35 (30)
December	,,	92 (92)	55 (57)	— (—)	33 (35)
January	1956	89 (92)	53 (56)	— (—)	34 (37)
February	,,	99 (97)	62 (61)	— (—)	35 (37)
March	,,	104 (104)	68 (68)	— (—)	23 (28)
Total				319·6 (462·8)	

N.B. Figures in brackets are returns for the 1954-55 season.

BREEDING.

(a) With the acceptance of BLR 14/25 (B_2 B_3 Sakel) as a commercial type and its expansion to 5,000 acres at Feragin in the coming season, an attempt has been made in the last two years to raise lint returns per acre from this quality type. Seed cotton returns for Domains Sakel and BLR 14/25 are nearly identical but *in the absence of blackarm* advantage lies with Sakel in its higher G.O.T., approximately 1·5% above BLR 14/25. With quality assured, it was considered wiser to seek for high yielding genotypes within the strain rather than attempt to raise the G.O.T. to the Sakel level. For this reason the two 10^3 cubic lattices of the past and present season were laid down. Reasons have already been given in the 1954-55 Report why progenies for the present season's lattice were taken from BLR 14/25 parental bulk rather than from the leafcurl 'filters' made at Shambat.

10^3 Cubic Lattice, 1955-56

Efficiency. Random block : Factorial 100 : 139	*lb. lint/acre*
Mean yield BLR 14/25. Parental bulk	418
Mean yield highest yielding progeny	651
Mean yield progeny rows selected	522
No. progeny rows selected: 43	
No. of progeny rows bulked	
Group I 4	608
II 20	524
III 19	497

Forty-three progeny rows were finally selected and according to yield level these were bulked to give the three groups BLR 14/25.5 Groups I, II and III. In the coming season these groups will appear in a small scale trial while the residue of seed will be propagated in isolation at Abu Guta.

(b) The adaptability and expansion of BAR XL1 (X1730A + B_2) in the Sudan* has been remarkable but it is considered that under very severe blackarm attack the gene B_2 is not enough. The combination of B_2 and B_3 can, however, under Gezira conditions give near immunity and the end point must ultimately be an L type carrying both these genes with yield and quality equal to the recognised standards of X1730A. In the past all B_2 B_3 types have just failed to qualify. The B_2 B_3 Sakel × B_2 B_3 L programme detailed in the previous report and comprising 18 lots of foundation stock has this object in view. The programme also involves the transfer of leafcurl resistance from the L to the S types and the build-up of variability in basic stocks: in fact, three objectives are involved.

Unfortunately the absence of leafcurl at Medani and the severe depredations of pink and spiny bollworm at Shambat make combined operations impossible at any one site; in consequence, a shuttle service of seed has been devised whereby progenies 'filtered' at Shambat for leafcurl resistance will be returned for quality testing at Medani.

The leafcurl problem is a difficult one, for factors other than genetic are involved. In fact, no commercial Sudan cotton grown at Shambat has shown any measure of resistance when subjected to abnormal conditions (out-of-season planting, ratooning, etc.).

However, if some measure of resistance can be transferred from the L to the S commercial types sufficient to tide the crop over the danger period of mid October—early November, then the tedious programme of grafting and budding at Shambat on segregating material will be justified.

(c) The transference of lint retention from *G. contextum* and Stormmaster to BLR 14/25 has been effected. With at least 4 main characters involved, of varying degrees of efficiency in retention, the genetical interpretation of results has been difficult. The problem is further complicated by the fact that the retention complex can change throughout the season, i.e., a plant showing good retention in its early bolls can show no retention in the later and vice versa.

Ten families with BLR 14/25 as control will be planted in a replicated trial in the 1956-57 season.

*166,141 acres in 1955-56.

(d) An isolated plot of 'salt tolerant' BLR 14/25 and BLR 14/25 parental bulk was bulk pollinated (brush). Seed from these *crossed* bolls will be grown in the laboratory under controlled conditions in the coming season and evidence should then be available as to whether the programme of filtering through salt solutions followed by general panmixis has in fact raised the level of salt tolerance: this through the elimination of susceptible types and/or through the building up of minor gene complexes for resistance.

Standard Testing.

The standard variety trials were planted at Turabi (North), the Gezira Research Farm (Centre) and Hag Abdulla (South) on the 14th, 17th and 18th August respectively: layout and general practice were identical with those of the previous season.

Planting conditions were easy and good establishment was obtained at all three sites.

In the North, yields must have been affected by severe whitefly attack and leafcurl was in evidence on all Sakel material. Blackarm made an early and unusual appearance and the value of resistant material was again apparent. BLR 14/25 (B_2 B_3) outyielded Domains Sakel by 10% (lint) while yield increases of 5% and 10% over X1730A were recorded in favour of BAR XL1 (B_2) and BAR XL3 (B_2) respectively.

At the G.R.F. in the presence of blackarm, BLR 14/25 outyielded Domains Sakel by 11% (lint): BAR XL1 and BAR XL3 were superior to susceptible X1730A by 7% and 9% respectively. Although whitefly attack was severe there was no leafcurl, not even on ratoon material.

Except for light whitefly infestation, the Hag Abdulla trial experienced ideal conditions from planting to final pick. Pests and diseases were absent and the crop received no check in its life history. An overall yield of 2,692 lb. of seed cotton per acre, one of the highest on record in the Southern V.T., reflects such conditions.

One point of interest is the response of Sakel and its derivative to season. Generally the response of S types to the climatic regime of the South is only fair, but conditions have been such that an all time record yield of 2,614 lb. of seed cotton per acre for S types has been established.

Relevant data are given in Table 2, with summarized performance for yield and spinning test figures in Tables 3 and 4.

Miscellaneous Testing.

(a) Groups I, II and III from BLR 14/25.4, derived from the cubic lattice of 1954-55, were planted in a replicated (5) experiment on August 14th. In view of the fact that all bulked progenies had significantly outyielded parental bulk in the original experiment, yield

TABLE 2.

GEZIRA VARIETY TRIALS, 1955-56.

YIELDS OF SEED COTTON AND LINT IN POUNDS PER ACRE.

Variety	*BAR Genes*	*Turabi (North)*			*G.R.F. (Centre)*			*Hag Abdulla (South)*			*Overall Mean*		
		Seed Cotton	*Lint*	*G.O.T.*	*Seed Cotton*	*Lint*	*G.O.T.*	*Seed Cotton*	*Lint*	*G.O.T.*	*Seed Cotton*	*Lint*	*G.O.T.*
S GROUP													
Domains Sakel		1481	455	30·7	1747	578	33·1	2628	817	31·1	1952	617	31·6
BLR 14/25 Gash	B_2 B_3	1709	499	29·2	1995	644	32·3	2599	785	30·2	2101	643	30·6
L GROUP													
X1730A Gash		1665	564	33·9	1858	676	36·4	2800	988	35·3	2108	743	35·2
BAR XL1 Gash	B_2	1753	592	33·8	1995	724	36·3	2760	977	35·4	2169	764	35·2
BAR XL3 Gash	B_2	1822	618	33·9	2040	738	36·2	2675	947	35·4	2179	768	35·2
Standard Error (Mean)			10·8			12·2			13·6				
Difference = 0·05			30·3			34·4			38·3				

TABLE 3.

SUMMARY OF PERFORMANCE OF CURRENT STRAINS IN GEZIRA VARIETY TRIALS UP TO AND INCLUDING SEASON 1955-56.

Variety	*Basic Type*	*Seed Cotton (lb./acre)*						*Lint (lb./acre)*						*Location*
		No. of Trials	*Mean*			*Variety as % of*		*No. of Trials*	*Mean*			*Variety as % of*		
			Variety	X1730A	*Dom. Sakel*	X1730A	*Dom. Sakel*		*Variety*	X1730A	*Dom. Sakel*	X1730A	*Dom. Sakel*	
Domains Sakel	S	17	1276	1291	1276	99	100	17	410	464	410	88	100	*Northern Gezira*
BLR 14/25	S	6	1529	1526	1525	100	100	6	485	552	500	88	97	
X1730A	L	17	1291	1291	1276	100	101	17	464	464	410	100	113	
X1730L–1	L	13	1332	1386	1364	96	98	13	476	497	444	96	107	
X1730L–3	L	4	1600	1579	1554	101	103	4	563	561	504	100	112	
Domains Sakel	S	30	1481	1743	1481	85	100	30	470	615	470	76	100	*Central Gezira*
BLR 14/25	S	6	1546	1523	1309	101	118	6	489	549	428	89	114	
X1730A	L	30	1743	1743	1481	100	118	30	615	615	470	100	131	
X1730L–1	L	14	1634	1530	1274	107	128	14	580	550	411	105	141	
X1730L–3	L	4	1671	1523	1247	110	134	4	589	544	408	108	144	
Domains Sakel	S	13	1351	1515	1351	89	100	13	430	536	430	80	100	*Southern Gezira*
BLR 14/25	S	6	1317	1412	1208	93	109	6	401	496	381	81	105	
X1730A	L	13	1515	1515	1351	100	112	13	536	536	430	100	125	
X1730L–1	L	13	1442	1343	1131	107	127	13	504	472	362	107	139	
X1730L–3	L	4	1640	1549	1286	106	127	4	571	544	404	105	141	

TABLE 4.

SUMMARY OF SPINNING TEST REPORTS ON CURRENT STRAINS IN GEZIRA VARIETY TESTS, 1942-43 TO 1954-55.

Variety	*Type*	*Effective Length 32's*			*Standard Hair Weight*			*Corrected Lea-Strength Products*					
		No. of Trials	*Mean*		*No. of Trials*	*Mean*		*No. of Trials*	*Means of 80's Counts*		*No. of Trials*	*Means of 100's Counts*	
			Variety	*Dom. Sakel*		*Variety*	*Dom. Sakel*		*Variety*	*Dom. Sakel*		*Variety*	*Dom. Sakel*
BLR 14/25	S	12	47	46	12	147	148	12	2531	2528	12	2236	2215
BLR 14/25.2	S	6	48	46	6	143·5	145	6	2526	2513	6	2231	2200
BLR 14/25.3	S	3	49	47	3	141	142	3	2544	2577	3	2231	2172
	Type	*No. of Trials*	*Variety*	X1730A	*No. of Trials*	*Variety*	X1730A	*No. of Trials*	*Variety*	X1730A	*No. of Trials*	*Variety*	X1730A
BAR 1730L–1	L	26	46	46	26	163	163	34	2064	2071	25	1802	1830
BAR 1730L–3	L	9	46	46	9	165	161	9	2228	2223	9	1838	1885

figures for Groups II and III for this experiment were disappointing. Under the conditions of the experiment, the 5·2% increase (lint) of Group I over control was not significant, but if such a difference could be established with certainty the position of BLR 14/25.4 Group I in relation to parental bulk and Sakel would be most satisfactory.

	Lint lb./acre	G.O.T.
BLR 14/25.4 Group I	528	30·2
Group II	479	30·6
Group III	495	30·5
BLR 14/25 Parental Bulk	502	30·4
S.E. (mean)	18	(non-significant)

(b) With fresh waves of jassid resistant Sakel arriving at Medani for testing each year it was necessary to take stock of the hairy material on hand with a view to elimination. Five hairy Sakel types (6th backcross F_5s carrying H_1 from Ferguson but not the full minor gene components from Ferguson) were sown in a replicated (5) trial with Domains Sakel as control. In terms of yield only one family, JR 1084, showed promise: the grade and staple of all families were inferior to control but further evidence is required from spinning test data.

Contrary to expectations, the transfer of the gene H_1 has not reduced the number of 'effective' (picked) bolls per plant.

	Lint lb./acre	G.O.T.	'Effective' bolls per plant
JR 1084	363	31·9	7·8
„ 1089	328	31·6	6·8
„ 1090	339	30·9	7·6
„ 1091	304	30·0	7·4
„ 1092	281	30·0	6·8
DS	374	32·0	6·3
S.E. (mean)	13		
Diff. (5% level)	40		

(c) A small scale trial of four replications containing the varieties BAR 4/24, BAR 4/16 and X1730A was planted on August 15th. This was the first occasion on which the new synthetic type BAR 4/24 (B_2 B_3 B_{am}) has appeared under test. The trial was very severely attacked by whitefly from the earliest stages of growth and both yield and grade must be regarded with some reservation. Hand stapling methods indicated that BAR 4/24 was slightly inferior to X1730A, a finding to be confirmed by spinning test data. The low G.O.T. of BAR 4/24 (30·6%) will have to be raised if this type is to compete successfully with standard commercial varieties (L).

		lint lb./acre	*G.O.T.*
X1730A (susceptible)	L type	505	35·0
BAR 4/24 (B_2 B_3 B_{cm})	„ „	441	30·6
BAR 4/16 (B_2 B_3)	„ „	465	32·7
S.E. (mean)		21	(non-sign.)

(d) Hopi Acala ex U.S.D.A. 1953 was tested against Acala 4.4.2, a quality type from America 1955, in a small scale trial planted on August 14th. Both strains suffered from blackarm attack (100% infection) but later recovered to give fair yields. In terms of boll weight, G.O.T. and quality, Acala 4.4.2. was most impressive. In support of the American claim, it would appear that the linkage between high G.O.T. and poor quality has in fact been broken in this strain. In addition to spinning test samples, lint of each has been sent to the Lancashire Cotton Corporation for assessment and valuation. Gene transferences of B_2 and B_3 to both Hopi Acala and Acala 4.4.2 are being conducted at Shambat.

	S/c lb./acre	*lint lb./acre*	*G.O.T.*
Acala 4.4.2	1237	505	40·9
Hopi Acala	829	266	32·3
S.E. (mean)	—	10.8	—
Sign. diff. (P = ·01)	—	47	—

Miscellaneous.

(a) Second generation seed of the 3 types BAR 7/8.2 selfed, natural and crossed* derived from the original Shambat material of 1953-4 was planted on August 15th in a replicated (6) trial. As was noted in the 1954-55 Report, crossed seed outyielded natural by 11% and it was the intention of this experiment to see how long such a 'boost' would last. It is evident from the data shown below that the 'stimulus' of the original cross has disappeared in the second generation. Similar results were obtained from a non-replicated plot.

BAR 7/8.2	Selfed	1368 lb. s/c per acre
	Natural	1271 „ „ „ „
	Crossed	1310 „ „ „ „

(b) Twelve seed lots, BAR 4/16 and BAR 5/6 (natural and selfed seed of each 1953-54) on which the treatments crossed (brush), natural and selfed had been superimposed in the 1954-55 season, were planted out in a replicated (12) trial on 15th August. It is evident from the results that with these 2 strains (both L types) no yield increase has been obtained by the brush technique. It must, however, be pointed

*By the standard technique: *not* by brush.

out that a different result might easily have been obtained using S types where the stigma is protuberant and not markedly enveloped by the antheridial column.

	S/c lb./acre		
	S	N	X (brush)
BAR 4/16	1150	1157	1157
BAR 5/6	1240	1159	1246

N.B. Original S and N treatments combined.

(c) Two strains of Pima, Pima S1 and Pima 32 reached the Sudan in mid 1955*. The two most striking features of these introductions were (1) extreme earliness (S1 node number 8·1: 32 node number 9·3: Domains Sakel node number 11-12) and (2) very high yield potential. In spite of the fact that both types showed full susceptibility to blackarm and there was much physiological shedding, yields and quality were of a high standard. If water economy through early water stoppage is envisaged in the Sudan such types could play an important part in 'earliness' transferences to current commercial types. The genes B_2 and B_3 are being added to both types at Shambat.

	S/c lb./acre	Lint	G.O.T.
Pima S1	1756	590	33·6
Pima 32	1875	642	34·2

Publications.

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Hughes, L. C.	'Gezira Board Cotton Grades 1935/36—1953/54. A Review of the General Situation. Miscellaneous Publication. G.R.F. No. 81 (a) (in Press).
Saunders, J. H.	'Bagging Cotton Flowers for Breeding. II. Endrin Treatment of Paper Bags'. E.C.G. Review, July 1956. Vol. 33, No. 3.
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*Through the courtesy of the U.S.D.A. and Sir Joseph Hutchinson.

SHAMBAT STATION

BY

S. O. S. DARK AND J. H. SAUNDERS.

Meteorology.

There was a negligible amount of rain during the summer. There were small showers at approximately weekly intervals from mid July to mid September. A heavy storm during the night of 27th August deposited 4·1 ins. in a few hours. The total rainfall for the season was 7·5 ins.

The monthly mean maximum temperature ranged from 106·9 °F. in May 1955 to 84·9 °F. in January 1956 with a mean maximum of 97·2 °F. for the year.

Genetics.

Production of Egyptian Varieties Resistant to Blackarm and Leafcurl.

Domains Sakel Derivatives: BLR 14/25.3 (B_2 B_3). Two final filters (the 4th and 5th) from the large propagation area (last season's report, p. 12) were made and tested for leafcurl resistance. Since they showed 94% and 96% susceptibility respectively (based on approximately 1,400 plants each with an average of 94% over the whole experiment of 4,200 plants), it is evident that there is no inherent leafcurl resistance to be selected from BLR 14/25.3.

It is, therefore, necessary to introduce leafcurl resistance into BLR 14/25 by crossing. The 'L' type of cotton which shows only 25% susceptibility has been used as the first donor parent. If this resistance becomes too diluted it may be necessary to use the much wider cross to *hirsutum* cotton which shows only 5% susceptibility.

Other Blackarm Resistance Transferences to Sakel and X1730.

BAR 4/24 (B_2 B_3 B_{6m}), which is the BAR 4/16 line to which the *arboreum* intensifying gene B_{6m} has been added, has been tested at Medani. Further selection will be necessary since although the seed cotton yield is satisfactory the G.O.T. has fallen to 30·6%. This season's propagation of the strain has been crippled by a whitefly attack at Medani and bollworm at Shambat.

Two further lines have been made for testing at Medani next season. They are from a further backcross generation to BAR 5/6 and are exactly equivalent to each other except for the presence or absence of the red flagging gene R_2^{RS}.

In the transference to Sakel type, the first backcross to BLR 14/25 is being selfed out to give a line homozygous for B_2 B_3 B_{6m} next year for preliminary testing in the following season. Two further

backcrosses have been made which should result in a satisfactory strain.

Investigation of the blackarm resistance transferred from *G. herbaceum* to Sakel is continuing.

In a small trial with 3 Sakel varieties, 4 'L' varieties and 3 *hirsutum* (American) varieties of cotton, and using blackarm inoculum obtained from Shambat and Kadugli, there was found to be a mean difference in grade of attack of 1·6 in the direction of greater virulence of the Shambat material.

Production of Blackarm Resistant Strains of American Upland.

Transferences involving B_{6m}. In the transference of the *arboreum* blackarm resistance intensifying gene B_{6m} from synthesised Sakels to BP52 derivatives, the first homozygous stocks were produced this season. Two further waves of backcrosses are in course of production.

The transference to BAR 11/7, BAR 7/8.1, BAR 10/3, BAR 20/1 and Wilds SUS 16/1 continues.

Jassid Resistance.

The work on jassid resistance in Sakel cottons to which hair has been added has ended its first phase, the actual production of hairy types. The second phase, already begun, will be concerned with the assessment of the value of hairiness with regard to crop production. This will include, of course, selection within the hairy strains for lint quality comparable with that in the non-hairy commercial Sakels. It has been shown (Pollard and Saunders, 1956) that the addition of hair to the lower leaf lamina (H_1 distribution) of Sakel cotton for the control of jassid does, in fact, increase the numbers of whitefly and aphids. This points to the necessity of finding an optimum type of hair distribution, density and length which will control jassid without unduly increasing other pests. Work in progress on the genetics of hairiness in cotton suggests that the production of a number of distinct types homozygous for different levels of hairiness is quite possible. It appears at the moment that the following regions of hairiness, which may be considered to be of importance to insect resistance, are under the control of distinct major genes whose individual effects are discernible:

a. Lower leaf lamina (H_1)
b. Upper leaf lamina
c. Stem, petiole and lower surface of veins (H_3)
d. Upper surface of veins

It is not known yet to what extent the genes controlling the hair on these distinct areas are independent of one another, i.e., whether each type can be extracted to breed true.

Amongst the hairy Sakels so far obtained two types are found. A fully hairy type H_1H_3 which combines all four classes, a, b, c and d above; and H_1h_3 which is a, b and d above, that is, without stem, petiole and lower vein hairiness. Work in the next season will reveal whether a type h_1H_3 can be extracted from hairy Sakels. Such a distribution has been observed among *G. hirsutum* cottons. It is considered, on the basis of observation to date, that a Sakel with h_1H_3 hair distribution may prove to be the most useful type for conditions on the Gezira.

Superimposed upon the distribution of hair as outlined above, controlled by major genes, are length and density of hair polygenically controlled.

Parallel to the work outlined above is the rendering of all jassid resistant stocks blackarm resistant. In all lines a considerable amount of backcrossing to Sakels homozygous for B_2 and B_2B_3 has been carried out. It remains to make these already highly resistant lines homozygous for the resistance factors which have been transferred to them.

In the current season 5 lines of hairy Sakels were tested at Wad Medani with promising results. Many more lines are now available for comparison with present commercial types.

Yield.

The transference of 4 and 5 loculed bolls from the American *hirsutum* cotton to BLR 14/25 has been accomplished. A preliminary test was conducted at Medani on open pollinated bulks of the 3-loculed (including 3·03-loculed) and 3·3-loculed plants from the 8th backcross of Ferguson to Sakel type with the results tabulated below:

Mean of 5 replications

	BLR 14/25	DS	Ferg. 3·3	Ferg. 3+3·03
Yield	42·9	36·3	33·0	36·4
Bolls/plant	10·4	7·8	11·7	11·3
3 loc bolls %	97·0	92·7	76·2	91·5
4 loc bolls %	3·0	7·3	23·2	8·5
5 loc bolls %	—	—	0·6	—
Loc. wt.	0·81	0·83	0·76	0·76
Seeds/loc	5·66	5·82	5·48	5·64
Motes/loc	0·34	0·18	0·33	0·37
G.O.T.	30·7	32·0	31·0	30·9
L. index	4·4	4·7	4·1	4·4
Seed wt.	9·9	9·6	9·5	9·3
Mean max. length	49	48·4	50	50
Mean max. range	46-52	46-52	46-53	45-52

These results show that in spite of the hybrid nature of the material, the number of 4 and 5 loc bolls has been significantly increased without much change in the characteristics of the lint.

The genetical situation is still very obscure. The present indication is that a major gene may be acting in the American cotton to permit the development of bolls with more than 3 locs. The actual

percentage of high numbered locs that are developed depends upon the accumulation of polygenic factors. In the absence of the major gene, a favourable accumulation of polygenes in individual plants will give occasional 4 loc bolls (as in Sakel cotton).

Families homozygous for the Ferguson factor have been derived from the 7th backcross for further testing.

Transference of the factors from Stoneville 20, Punjab 268F, Punjab 244F and T611 is continuing, but it seems likely that they all have the same or a similar basic gene but differ in their accumulations of polygenes.

27 strains (including BLR 14/25 control), 24 of which were derived from *G. auritum* × BLR 14/25 hybrid material, were assessed for ovule number. This entailed the counting of all ovules on 5 flowers of 1,620 plants. 262 plants were selected as having ovule numbers superior to the general level of BLR 14/25 and were selfed. Later, lint lengths were obtained from these selections. From the combined data of ovule number and lint length the number of selected plants was reduced to 144. A few of the more outstanding plants (e.g. 8·53 ovules per loc, 49·2 mms. lint length) will be carried on as progeny rows. The remainder will form about 10 groups bulked according to a joint consideration of ovule number and lint length. Some of these bulks will be split to provide (a) seed for varietal tests at Wad Medani and (b) seed for multiplication, reselection, blackarm grading and roguing at Shambat. In addition to the 27 strains tested, a number of multiplication plots were grown from bulks of single plant selections from the previous year. All multiplication plots are mass mixed pollinated by hand and protected from cross pollination by bags. Since ovule number is thought to be polygenically controlled, further increase is being sought by combining, in as many ways as possible, all plus factors for ovule number contained within plants already selected for high ovule number.

Two bulks N39/54 and N40/54 were tested at Medani this year. No outstanding results were expected since these are the very first strains to be tested. However, they each yielded as well as the controls (DS and BLR 14/25) and in addition showed significantly greater seed number per boll. This is a hopeful sign that breeding for increase in yield via ovule number selection is profitable.

Examination of ovule number and lint length data shows the two characters to be apparently independent of each other.

With regard to the ultimate breeding of fully blackarm resistant high ovule number lines of Sakel cotton the present status is such, as a result of at least three backcrosses to B_2B_3 Sakel (BLR 14/25), that a high degree of resistance already exists. This will be concentrated by roguing of susceptibles after artificial inoculation with blackarm. It is not, however, intended to aim for complete homozygosity by way of

single plant selections until a satisfactory high ovule number is first stabilised within each strain. In this way much valuable material will remain in circulation, available for combination and selection.

Type Collection.

The first cycle of the programme of seed replacement has now been completed for the type collection with the growth this year of the centre of origin *hirsutums* apart from the *latifolium* section.

Exploitation of Wild Gossypium Species.

G. thurberi. The work on transference of high lint strength was continued, using BLJR 14/29 as the backcross parent. There are now indications of a possible pattern of inheritance of this character.

G. anomalum. Further families were examined in an effort to transfer characters to Sakel type cotton and to investigate the make-up of the 'B' genome.

Bollworm Resistance.

In the transference of bollworm resistance from *G. thurberi* to BAR 11/7, selections were made last year from segregating F_2 families with the object of obtaining this season true breeding families for resistance. 58 F_3 families and 33 backcross families were grown and scored. A very light bollworm attack on this plot made scoring for resistance extremely difficult. An individual plant score for resistance was calculated (see last season's report, p. 15), but a frequency graph had to be plotted for every family to determine whether it was segregating or not. Various independent calculations agreed that susceptible plants were distributed around a mean index of 65% and resistant ones around a mean index of 80%.

The table below summarizes this season's results:

	Homozygous	*Segregating*	:	*Expec. 1:2*	
F_3 Families self bred	12	19	:	10	21
F_3 Families natural seed	3	16	:	6	13
Back cross families	2	11	:	4	9
	17	46	:	20	43
Cross-check families in agreement					
Self., Nat., Bc.	1	0	:		
Self., Bc.	1	6	:		
Nat., Bc.	0	2	:		
Self., Nat.	0	2	:		
	2	10	:	4	8
Totals	19	56	:	24	51
Cross-check families disagreeing	5				

It was possible to raise more than one type of family from 17 of the selected plants, i.e., by self-fertilizing, by natural pollination and by backcrossing. These are classified in the table as "cross-check" families. Three types of family were raised from one plant and two types (in 3 combinations) from 11 plants. In each case there was agreement between the derived families in that all those originating from a single plant segregated in a fashion to indicate either homozygosity or heterozygosity. In 5 other cases, however, plants for no apparent reason gave rise to apparently both segregating and non-segregating families.

The remaining seed was used for a second sowing in early December. A small plot with replicated arrangement and plenty of susceptible plants was laid out. A really heavy bollworm infestation resulted. The full results are not yet available but there is evidence that fully susceptible families had a mean score of 45% and a fully resistant family 65% while individual plants scoring 60% in segregating families could be considered resistant. These values correspond to those found last year (see last season's report, pp. 15-16).

The actual amount of loss caused by the bollworm attack is considerably greater than these loc counts indicate. These plants were fairly closely watched and it was found that a great many flowers attacked by bollworm are shed before they even start swelling a boll.

There were also 5 families grown for the direct transference to BLR 14/25. These families were natural seed F_4s and are summarized in the following table, where resistant plants were those with score of 75% or higher:

Family	*Total Plants*	*Percentage of plants*			*% Resis. plants*
		Resistant	*Susceptible*	*Sterile*	*(R/R + Sus.)*
PE 92/55	163	12	48	40	20
PE 93/55	155	7	48	45	13
PE 94/55	31	13	64	23	17
PE 95/55	129	19	33	47	35
PE 96/55	87	43	29	29	60

These families still show a high degree of sterility and in the first 4 of them the percentage of resistant plants is very low. Hence it is probable that resistance in these families has not "crossed in" to the *barbadense* genome but is being carried haphazard in an extra chromosome from *thurbadense*. In family PE 96/55, however, the percentage of resistant plants shows a considerable increase while at the same time the sterility has been reduced.

In the transference involving *armourianum* via the hexaploid *G. armadense,* two families were raised with the results shown below:

Family	*Total plants*	*Percentage of plants* *Resistant*	*Susceptible*	*Sterile*	*% Resis. plants (R/R + Sus.)*
PE 97/55	139	32	27	42	54
PE 98/55	164	9	26	65	25

As the table shows, sterility is still very considerable in these families, but backcrossing to both *hirsutum* and *barbadense* has been attempted this season.

Leafcurl.

Two experiments in which individual labelled plants were scored through the season showed that the 4 grades of leafcurl, described by certain stages of vein thickening of the leaf, do not describe the severity of attack, but are largely a measure of the length of time that the plant has been infected.

The resistant wild species, *G. sturtii* and *G. stocksii,* have both been grafted on to leafcurl infected *G. barbadense* stocks. A leafcurl infected scion was also grafted on to a *G. stocksii* plant. In every case the wild species plants look perfectly healthy, but until insect proof houses are available it is not possible to test whether these wild species are immune or are symptomless carriers of the virus.

The attack developed by natural infection on 10 varieties of cotton, sown late in-season (25th September) and not ratooned, was found to be as follows:—

Variety	*% plants showing vein thickening 16th Jan.*	*% plants showing vein thickening 6th June.*
Sakel types		
BLJR 14/29	58	100
Dom. Sakel	97	100
BLR 14/25	98	100
'L' types		
XL1	15	87
X1730A	24	97
BAR 4/16	25	91
BAR 5/6	24	94
American (*hirsutum*)		
SUS 7/2	5	90
BAR 7/8.2	4	82
SUS 16/1	5	78

Diseases and Pests.

There was little natural blackarm attack and on the blackarm breeding plots some difficulty was experienced in getting a good "take" of the disease in the families segregating for extremely high resistance.

Wilt on what had been a badly infected field was patchy but not bad. It is not known whether this improvement was due merely to season or the very deep ploughing and subsequent sun baking to which this plot was subjected two years ago.

Some concern was caused by the discovery of the powdery mildew *Leveillula taurica* on the leaves of some of our out-of-season cotton. It had never before been described on this host. A pathologist, however, demonstrated that this was not a new physiological form of the fungus but that it could be transmitted from several common weed plants and also from beans. It appeared not to inconvenience the cotton plants and was eliminated from them by dusting with flowers of sulphur or by spraying with lime sulphur.

Aphids, whitefly and jassids launched their usual attacks and bollworms (mostly pink) were devastating everywhere, except on the bollworm resistance experiment. In an isolation area we obtained some control over the bollworm attack by two sprayings with endrin, the unsprayed strip giving 3·4 lb. of seed cotton compared with 5·0 lb. from the sprayed strip. This plot was subsequently attacked by mealy bug which had to be eliminated by cutting out and burning.

Leafcurl was widespread but only devastating on some of the late sown cottons, including *hirsutum* varieties.

KADUGLI STATION

BY

M. F. ROSE AND A. LOW.

The Commercial Crop.

A glance at the rainfall table points to an adverse season, probably the worst on record. At all stations where rainfall was recorded, total figures for the year's rainfall fell well short of average. In terms of sowing and establishment, the rains (June, July and August) were extremely variable, causing much irregular growth both within and between areas. Although the intake of seed cotton at the Kadugli ginning factory was at a high level (240,000 small kantars*) only a small percentage of this was contributed by Kadugli and its immediate environs: the bulk of the crop came from buying posts south of Kadugli where rainfall was more favourable. By the end of August Kadugli had received only 57% of its average rainfall to that date and many cotton areas were abandoned. Had it not been for average precipitation at Abu Gubeiha, Dilling and Umm Berembeita during August no crops would have survived and the Khor Abu Habl would not have flowed at all.

*1 small kantar = 100 rotls = 99 lb. seed cotton.

Temperatures followed the usual pattern of an equable climate from May to December, cool to cold weather until February and very warm and humid conditions until May. Relevant meteorological data are given in Table 5.

TABLE 5.

RAINFALL, NUBA MOUNTAINS, 1955.

MMS.

Station	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Total Rainfall 1955*	*% of Average*
Kadugli	28	63·5	65	64	88·5	168	71	548·0	71
Dilling	8	32·5	48·5	67·7	157·0	59	100	472·7	68
Lagowa	—	—	104·0	49·5	107·5	161	67·5	489·5	70
Talodi	71	67·0	123·0	82·0	147·0	101	163·0	754·0	92
Kalogi	36	69·0	60·0	174·0	224·0	119	64·0	746·0	96
Abu Gubeiha	—	13·0	90·0	121·0	150·0	102	110·0	586·0	82
Umm Berembeita	4·5	34·0	14·5	84·0	144·0	107	87·0	475·0	73
Abbassiya	17·0	30·5	106·0	227·5	160·5	45	119·5	706·0	102

Temperatures F° (Kadugli).

	M. max.	*Range*	*M. min.*	*Range*
Period Resting: December 1954—May 1955	100	106-97	64	72-58
Period Growth: June 1955—November 1955	92	99-86	68	72-63

The original refusal by the cultivators to take the free issue of seed, in protest against the revised payment system, resulted in delayed sowing in parts. This was not entirely a disadvantage, as the June drought had been very apparent and those who had sown early were forced to resow and in many cases more than once until their seed was exhausted. Nevertheless seedling cotton was still being found in late September even when it was obvious that there could be no economic return. These late sowings were extremely deleterious to the crop as they contributed to the already marked variability in staple: in general cotton grown along the 12° parallel, the marginal area for the rainfed crop*, was particularly poor in both yield and quality.

Thus the commercial crop can at the best be expected to be poor (less than 1″ staple), particularly the later marketed lots.

*The Abu Habl Scheme of controlled flooding, situated 60 miles N.E. of Dilling (12° N.) is treated as a separate entity, distinct from the Kordofan rainfed crop.

The seed issue for the Jebels this season was reduced from 96,000 (1954-55) to 80,000 small kantars: this coupled with the very poor season was responsible for the drop in the commercial crop from 906,000 small kantars of seed cotton to 600,000.

Pests were widespread but variable in severity of attack. Flea beetle caused local and in some cases severe damage even to the mature plants. Leaf roller and stainer bug (*Dysdercus fasciatus*) were present in appreciable numbers but again their attack was local. Of the damage caused by bollworms, that by Sudan bollworm was most severe and widespread.

Ramularia was more widespread than *Xanthomonas malvacearum* (blackarm). It certainly caused more damage than blackarm in certain areas, producing dried up leaves which subsequently were shed in large numbers. Vein lesions induced by this fungus at approximately 10 days from initial infection were on occasions wrongly diagnosed as blackarm, and casual observers reported the appearance of a new strain of blackarm and/or the breakdown in resistance of B_2 B_3 material: that *Ramularia* is on the increase in the Jebels must not be lost sight of and a careful survey of all strains in the standard variety trials will be made in future: to date no evidence is available as to relative susceptibility.

Breeding.

(a) The 'Testing Phase' of BAR 11/7 (a balanced lattice of 9 replications and 68 progenies) was eventually abandoned after 6 weeks of continuous hand watering. Final establishment was inadequate and the trial averaged 80 lb. of lint per acre. Fortunately, enough seed is available from the original stock to repeat the experiment in the 1956/57 season.

(b) From the 275 single plants of BAR 7/8.1 selected for reduced seed coat nep (15% and less) in the 1954-55 season, a small isolated bulk was grown. From this, 1,000 typical plants were taken which normally would have entered the 'Breeding Phase' in 1956-57. However, owing to the 'repeat' testing of BAR 11/7 this procedure will have to be shelved for a year. These 1,000 single plants showed a range of seed coat nep from 6 to 60% with a mean value at 23%. There are indications that a slight shift in mean value has been made toward improvement and bulked seed from the plot residue will enter the Kadugli variety trial in the coming season as Bar 7/8.3. This will afford a direct comparison with parental bulk as to the reliability of any advance.

Testing.

Kordofan.

Variety trials were laid down at Kadugli (6th July), Talodi (8th July), Dilling (17th July), Lagowa (20th July), and Abu Gubeiha (24th July). This was the first standard trial held at Abu Gubeiha and represents a crop of 100,000 small kantars.

Planting was delayed at the last three sites due to lack of rains, the recommended date of sowing being the first week of July. Layout was identical at all sites except Kadugli where a 6 × 6 Latin square was finally established. Here plot size was 0·025 acres instead of the 0·026 acres for the randomized block layout of 8 replications. Spacing was at 90 × 45 cms. with 3 plants per hill at final thinning.

All five trials were poor to very poor both in yield and grade with Dilling at the extreme end of the range. This site was badly affected not only by inadequate rainfall but by a hail storm which destroyed all early flowers and bolls.

Yield figures are shown in Table 6 and are included for record purposes only. The improvement in the relative position of BAR 11/7 in the worst season on record is worthy of note.

Darfur, Tozi, Equatoria.

Through the courtesy of the Senior Inspector, Darfur, the Senior Research Officer, Tozi, and the Senior Research Officer, Yambio, variety trials were laid down in Darfur (2), Tozi (1), and Yambio (2). Except at Tozi, in the Central Rainlands, all trials were patterned on the Kordofan layout. Unfortunately, the theft of seed cotton from the two Darfur trials rendered them useless for analysis and these were eventually abandoned. Relevant data from the other two localities are given in Table 7. Short staple and immaturity in all varieties from Tozi have cast serious doubts as to whether the spacing of 28 inches × $4\frac{1}{2}$ inches × 1 plant per hill is not too narrow for Tozi conditions. A series of spacing experiments using BAR 7/8.1 (quantity) and BAR 11/7 (quality type) should help to resolve the problem in the coming season.

A summary of performance of current strains in Kordofan variety trials up to and including season 1955-56, and spinning test figures up to and including season 1954-55 are shown in Tables 8 and 9.

Miscellaneous.

Ridging versus Flat Cultivation.

Two randomized block experiments of four replications each were laid down at the rainfall extremes, Dilling and Talodi, on 20th and 19th July respectively. The object of the experiment was to gain

TABLE 6.

VARIETY TRIALS, NUBA MOUNTAINS, 1955-56.

YIELD SEED COTTON AND LINT IN LB. PER ACRE.

	Kadugli			*Talodi*			*Lagowa*			*Dilling*			*Abu Gubeiha*			*Overall Mean*		
	S/c	*Lint*	*G.O.T.*	*S/c*	*Lint*	*G.O.T.*	*S/c*	*Lint*	*G.O.T.*	*S/c*	*Lint*	*G.O.T.*	*S/c*	*Lint*	*G.O.T.*	*S/c*	*Lint*	*G.O.T.*
BAR 7/8.2	645	210	32·6	809	273	33·9	615	210	34·2	204	65	31·8	410	122	29·8	537	176	32·8
BAR 7/8.1	650	217	33·3	589	204	34·7	578	198	34·2	189	62	32·8	390	118	30·3	479	160	33·3
BAR 11/7	715	202	28·3	850	254	29·9	605	184	30·4	191	58	30·4	440	124	28·2	560	164	29·3
BAR SP84	523	151	28·8	539	163	30·3	568	172	30·3	167	46	27·5	422	118	28·0	444	130	29·3
PSS	552	151	27·4	520	152	29·2	546	160	29·3	65	17	26·2	382	103	27·0	413	117	28·3
BAR 7/3	611	183	30·0	—	—	—	—	—	—	—	—	—	—	—	—	611	183	30·0
S.E. (Mean)		12			14			8			6			5				
Difference P=0·05		36			40			23			18			Not significant				

S/c=Seed Cotton.

TABLE 7.

VARIETY TRIALS, TOZI AND YAMBIO, 1955-56.

Variety	*Tozi, Central Rainlands*			*Yambio*					
				1st year land			*2nd year land*		
	S/c lb./acre	*G.O.T.*	*Lint lb./acre*	*S/c lb./acre*	*G.O.T.*	*Lint lb./acre*	*S/c lb./acre*	*G.O.T.*	*Lint lb./acre*
BAR 7/8.2	1813	36·3	658	841	37·3	314	849	37·3	316
BAR 7/8.1	1557	36·6	570	923	36·1	333	696	36·1	257
BAR SP84	1429	31·7	453	729	34·9	255	712	34·9	252
BAR 11/7	1478	32·2	476	849	34·9	297	801	34·9	280
BAR 11/5	—	—	—	787	34·9	274	672	34·9	234
PSS	1199	29·7	356	—	—	—	—	—	—
S.E. (mean)	—	—	21			16			12
Diff. (5% level)			61			47			35
Planted 22.6.55. Picking 2.11.55 to 2.1.56. Randomised Block Layout. Spacing 28" × 4½". 1 plant per hill.				Planted 15.6.55. Picking 1.11.55 to 10.1.56. Randomised Block Layout. Standard spacing at 90 × 45 cms. at 3 plants per hill.					

General Comment: As in Kordofan, the relative position of BAR 11/7 appears to be improving.

Table 8.

Summary of Performance of Current Strains in Kordofan Variety Trials up to and including Season 1955-56.

Variety	Seed Cotton (lb./acre)				Lint (lb./acre)			
	No. of Trials	*Variety*	*PSS*	*Variety as % of PSS*	*No. of Trials*	*Variety*	*PSS*	*Variety as % of PSS*
PSS	76	891	891	100	67	255	255	100
BAR SP84	33	806	831	97	33	255	243	105
	Seed Cotton (lb./acre)				*Lint (lb./acre)*			
	No. of Trials	*Variety*	*BAR SP84*	*Variety as % of BAR SP84*	*No. of Trials*	*Variety*	*BAR SP84*	*Variety as % of BAR SP84*
BAR SP84	37	899	899	100	37	284	284	100
BAR 11/7	9	693	635	109	9	208	191	109
BAR 7/8.1	17	716	638	112	17	243	191	127
BAR 7/8.2	13	712	610	117	13	239	181	132
BAR 7/3	13	861	857	101	13	276	263	105
PSS	33	831	806	103	33	243	255	95

Table 9.

Summary of Spinning Test Reports on Current Strains in the Nuba Mountains up to and including 1954-55.

Variety	Effective Length 32nd's			Standard Hair Weight			Corrected Lea-Count × Strength Product		
	No. of Trials	*Mean*		*No. of Trials*	*Mean*		*No. of Trials*	*Means of 40's*	
		Variety	*BAR SP84*		*Variety*	*BAR SP84*		*Variety*	*BAR SP84*
PSS	25	36	38	25	194	196	25	2168	2130
BAR 7/3	9	36	37	9	200	193	9	2010	2072
BAR 11/7	4	36	36	4	194	201	4	2327	2005
BAR 7/8.1	8	36	36	8	194	188	8	1822	2072
BAR 7/8.2	4	36	36	4	186	201	4	1683	2023

further information on the relative value of ridging tied (RT), ridging (R), and flat (F), these main treatments being the same as in the previous season's experiment. Main plots were split into sub-plots with varieties BAR 7/8.1 (B_2 B_3 resistance) and Pump Scheme Strain (b_2 b_3) on which were superimposed the 4 seed treatments Perecot 45, YF 3225, YF 3477 and control. Main plot size at Dilling and Talodi was 0·065 and 0·129 acres respectively with spacing at 90 × 45 cms. and final thinning to three plants per hill.

For the second season running (and both can be regarded as atypical) 'flat' again showed its superiority in yield to the other two treatments, with varietal response to main treatments similar. For the control of primary blackarm infection, YF 3477 on Pump Scheme Strain was the most effective at both sites, with Perecot 45 the worst. From the figures shown below it would appear that YF 3477 would confer little advantage to B_2 B_3 protection.

Lint lb./acre (over strains and dressing)

	Talodi (754 mm.)	*Dilling (473 mm.)*
(R)	111	69
(RT)	189	91
(F)	209	103
S.E. (mean)	26 (non-signif.)	10 (non-signif.)

% B/A infection 6 weeks from planting

PSS Control	74·0	21·0
,, Perecot 45	42·5	8·5
,, YF 3225	42·0	5·5
,, YF 3477	4·5	1·5
BAR 7/8.1 Control	1·5	2·5
,, Perecot 45	1·0	1·0
,, YF 3225	0·5	2·5
,, YF 3477	0·0	1·5

Propagation.

Two-thirds of the Nuba Mountains crop was sown with BAR 7/8.1, but the issue at Subu in the south and at the Abu Habl in the north was not utilized owing to lack of interest in the former case and lack of rain in the latter. Further admixture in the Kalogi area and other areas was reported, again emphasizing the importance of one variety in areas where cast-iron control cannot be exerted. In the coming season all the Jebels will be under BAR 7/8.1, including the Abu Habl.

At El Effein two isolation areas each of two feddans were sown out to BAR SP84 (Rose's Reselected) and BAR 11/7, for type maintenance.

Appendix.

Key to Symbols Used in this Report.

Egyptian S types.

DS	Domains Sakel originally imported from Egypt.
BLR 14/25	A Sakel type carrying B_2 and B_3.
BLR 14/25.4 and 5	4th and 5th filter for yield.
BLJR 14/29	A hairy Sakel homozygous for B_2, B_3 and H_1.
BLJR 14/36	As BLJR 14/29 but also carrying the Ferguson hairiness complex.
G. auritum	A *barbadense* type with high ovule number per loc.
G. armadense	A synthetic hexaploid obtained by crossing *G. armourianum* and *G. bardadense* and doubling the chromosome number of this triploid.

Egyptian L types.

X1730A or XA	Successor type to X1730.
XAG	X1730A Gash grown.
XAT	X1730A Tokar grown.
XAT1	1st filter of XAT.
BAR XL1 BAR 1730L1	1st filter of BAR 1730L.
BAR XL3	3rd filter of BAR 1730L.
BAR 4/16	An X1730A type carrying B_2 and B_3.
BAR 5/6	As BAR 4/16 but carrying the red *arboreum* gene R_2^{RS}
BAR 4/24	An X1730A type carrying B_2, B_3, B_6m.

American Upland.

BAR SP84	The blackarm resistant component of Uganda SP84.
BAR 7/8.1 BAR 7/8.2	BAR SP84 carrying B_2 and B_3 1st and 2nd filters.
BAR 7/3	A selection from BAR SP84 for improved G.O.T.
BAR 7/1.2	A very early component selected from BAR SP84 giving a very high yarn strength.
BAR NT96	From the cross '57 × Over-the-Top' (carrying B_2).
BAR 20.1	BAR NT96 'cluster type' carrying B_2.
Pump Scheme Strain (PSS)	An old commercial bulk deriving from Nyasaland Upland.
BAR 11/5	XA129 (PSS) carrying B_2.
BAR 11/7	XA129 ,, B_2 and B_3.
BAR 10/3	A Deltapine type carrying B_2.
MU8b	Malwa upland type (from India).
BP52	An upland type (commercial) from Uganda.
Stoneville 20	A direct importation from the Belgian Congo.
Wilds SUS 16/1	American long staple type: irrigated.
Ferguson	A hairy American type from the Philippines (via Trinidad).
Clevewilt 7	An American commercial, S. Carolina.
P268F P244F	American importation direct from India.
Pubescent T611	An upland cotton carrying H_2 supposed to have arisen by mutation.
Hopi Acala	A very early type directly imported from U.S.A., 1953: of high intrinsic fibre strength.
Acala 4.4.2	A high quality American importation, 1955.

Genes.

B_1	A weak dominant blackarm resistance factor from Uganda B31.
B_2	A strong dominant blackarm resistance factor from B31.

B_3	A partially dominant blackarm resistance factor from *G. punctatum*.
B_4	A partially dominant blackarm resistance factor from *G. arboreum*.
B_5	A partially dominant blackarm resistance gene from 'Grenadines White Pollen'.
B_{6m}	A blackarm resistance intensifier from *G. arboreum*.
B_7	A partially dominant blackarm resistance gene from Stoneville 20.
b_8	A recessive blackarm resistance gene from *G. anomalum*.
H_1	A hairiness gene from Tanguis.
H_2	A hairiness gene from *G. tomentosum*.
H_3	A partially dominant hairiness gene controlling the distribution of hairs on the plant.

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